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ABORIGINAL FIRE-MAKING.

BY WALTER HOUGH.

Twenty years ago Paul Broca remarked: "These three distinct things must not be confounded—the knowledge of fire, the means of utilizing it, and the means of procuring it."* This caution was addressed to students of primitive society, in reference to which theories have originated based on observed facts of development. The above order seems to be the logical one, but demonstration is possible only in the two latter stages.

The first stage is theoretic only; for no tribe has ever been found ignorant of the use of fire, and the Andamanese, who are in the stage of fire preservation, are the only people the writer has been able to discover unacquainted with some method of generating fire at will.†

Numerous fire-origin myths have been collected from peoples of widely different culture. Nine-tenths of these myths relate that fire was brought down from above, or from a place where it was monopolized by the cunning or theft of some man or zoöomorphic hero. It is presumed that all fire-origin myths refer to the invention of some process to make fire easily. It is only necessary to mention the Prometheus myth as a type.

Many myths afford clues to the earliest apparatus for fire-making. Prometheus brought fire from heaven in a hollow reed. The cognate Hindu myth is more explicit, relating that the carpenter ground out fire from wood, and gives details of the compound machine used, which latter is found in every Hindoo temple. Kuchiya-Tama drilled fire from wood in early Japan; in China Suy-jin was the culture hero; Genos of the Phenicians taught men to make fire by wood friction, and so on through the list.

An addition to this body of evidence may be cited that carries the use of the simple drill farther back than probably any myth. Dr. Cyrus Adler, of Johns Hopkins University, has called my attention to the probability of the existence of the fire-drill among the non-

* Societe d'anthropologie, Bulletins, 2 s., V. 1870, p. 70.

† E. H. Man. The Andaman Islanders. Lond., 1883, p. 82.

Semitic aborigines of Babylonia. Prof. A. H. Sayce in the Hibbert Lectures* states that fire was produced in Babylonia, as in other countries of the ancient world, by rubbing two sticks one against another. Dr. Adler is inclined to think that the matter can be more definitely stated. The Akkadean word for fire god is *Gibil*, compounded of *gi*, which means reed, and *bil*, fire. This composition of the name points to the existence of a fire-making apparatus among the aborigines of southern Babylonia, of which the reed, *gi*, forms a part. This may have been used as a part of an upright drill like the Piute specimens collected by Major Powell, or after the manner of the Malays, by sawing one piece across another.

The following is a classification of the chief methods of fire-making by friction based upon the presumed order of development:

- | | | |
|--|---|---|
| I. On wood (reciprocating motion) by— | { | 1. <i>Simple two-stick apparatus.</i>
Indians of North, Central, and South America; Ainos, Japan; Somalis, Africa; most Australians, &c. The most widespread method.

2. <i>Four-part apparatus: mouth drill, and two-hand drill.</i> Eskimo, some Indians, Hindoos, and Dyaks.

3. <i>Compound, weighted drill.</i>
Iroquois and Chukchis. |
| II. On wood (sawing motion) | } | Malays and Burmese. |
| III. On wood (plowing or planing motion) | } | Polynesians; some Australians. |
| IV. Of minerals. (Percussion) | { | 1. <i>With pyrites (or stone containing iron) and flint.</i> Eskimo and Indians of the North (Algonkian and Athapascan stocks).

2. <i>Flint and steel.</i> Modern and disused methods and appliances. |

Besides the lens, mirror, and aerophore† there are pyrophores, the hydrogen lamp, matches, and various chemical and electrical methods that are beyond the scope of this paper.

There is a prevalent belief that to make fire by friction of two sticks is very difficult. Such is not the case. The writer can make fire in 10 seconds with the twirling-sticks and in five seconds with

* Origin and growth of Religion as illustrated by the Religion of the Ancient Babylonians, London, p. 180.

† American Anthropologist, i, 1888, p. 294.

the bow-drill. Captain John G. Bourke, U. S. A., furnishes corroborative testimony on this point* to the effect that the Apache can generate fire in less than 8 seconds. Most tribes make fire on wood in less than two minutes; if a longer time is consumed, it is probable that the people under observation are not properly prepared, or are practicing a waning art.

Generalizations with respect to fire-making have been made from the theoretical difficulties presented without recourse to a practical test. An experiment is a question put to nature, a fact which should not be forgotten by anthropologists as well as physicists.

The origin of the *culte de feu* is based on these theoretical considerations. "The difficulty, the impossibility almost, for certain tribes to produce fire for themselves makes it necessary to jealously preserve it; there is then nothing astonishing in the fact that it was respected and adored; and the appointment of Vestals charged with its preservation comes without doubt from the same idea." This is a late utterance by Sir John Lubbock.† It was adored, no doubt, as were other natural forces, because of its mysterious nature and origin. To its sacred and religious character, and not to the difficulty of procuring it, is due its preservation by special functionaries in a later stage of culture. The Vestals would have had no trouble to rekindle their fire. It was not their custom to moisten the sticks as does the Zufi priest, according to Mrs. Stevenson, before making his sacred fire, possibly on the principle that what costs most is most valuable; or, more probably, because sacred fire must not be procured by the common method. Neither Eskimo nor Indian is careful to preserve fire, since a new spark can be obtained in half a minute. These tribes are far removed from primitive man, but it appears probable that when early man once learned the art he could obtain fire at will.

The retention of the wooden apparatus for so long a time among the different peoples is an interesting fact. In the case of many tribes familiar with quicker methods, this survival has doubtless resulted from religious influences. In several instances the green-corn dance, a cultus ceremony of our Indians, has brought the art down to our day, when otherwise it might have been lost. It is well known, too, that fire generated from wood is esteemed more efficacious by semi-cultured peoples. The reason for this belief

* American Anthropologist, iii, 1890, p. 61.

† A Conference upon the Savages. Toynbee Hall. London, 1887.

may be found in the respect and reverence for old customs—ancientism. The art has also progressed and there have been improvements in the apparatus, selection of wood, tinder, etc. No doubt fire can now be made more easily and in a shorter time than formerly.

Many travellers testify that they have observed various peoples make fire afresh by friction with sticks of wood. The most common way, by twirling one stick upon another, is well described by Pere Lafitau*: “The Hurons, the Iroquois, and the other peoples of North America do not make fire from the veins of flint, but rub two pieces of wood, one against the other. (Fig. 1). They take two pieces of



FIG. 1.—Simple two-stick fire-making apparatus.

cedar wood, dry and light ; they hold one piece firmly down with the knee, and in a cavity which they have made with a beaver tooth or with the point of a knife on the edge of one of these pieces of wood, which is flat and a little larger, they insert the other piece, which is round and pointed, and turn and press down with so much rapidity and violence that the material of the wood, agitated with vehemence, falls off in a rain of fire by means of a crack or little canal which leads from the cavity over a match (of frayed cedar bark). This match receives the sparks which fall and preserves them for a long time and from which they can make a large fire by touching it to other dry materials.”

Even the best descriptions, however, omit details essential to the

* *Moeurs des Sauvages Américains*, 1724, vol. ii, p. 242-3.

success of the process. Few note, for instance, the great knack in twirling the stick. It is held between the palms of the outstretched hands, which are drawn backward and forward past each other almost to the finger tips, giving the drill motion, and at the same time a strong downward pressure is given. The hands, of necessity, move down the spindle; when they nearly reach the lower end they are quickly shifted to the top without moving the drill from the hole, and rotation is repeated as rapidly as possible. Very shortly a light-colored wood powder is ground off by the point of the drill and collects in the slot, Lafitau's canal. Soon the powder increases in quantity and begins to get darker; the smell of burnt wood is

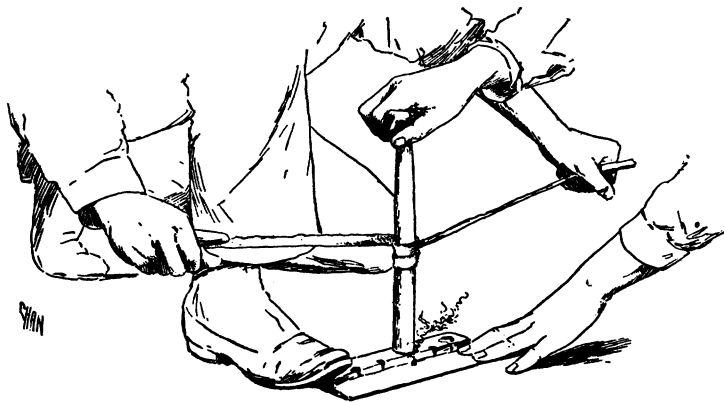


FIG. 2.—Eskimo two-handed fire drill.

speedily noticed and then smoke is seen. Probably when the next motion ceases there will be a little curl of peculiarly colored smoke, which shows that active combustion has begun. The mass of wood powder may now be shaken out of the canal.

At first it looks dead were it not for the thin line of vapor that comes from it. Gradually the fire spreads through it until it glows.

This semi-carbonized dust seemingly acts as a muffle to retain the increment of friction-heat until it attains 450° or higher. The dust must remain in an undisturbed heap; it is impossible to make fire without observing this caution.

In the case of the Eskimo compound drill the actual operation is similar to that in the simple drill described; the only difference is in the details of the mechanism which mark it as an improvement on the earlier form. (Fig. 2).

The Eskimo compound drill is of two varieties—one worked with a thong and hand-rest by two persons (Fig 2), and the other worked by one man with the aid of a bow and mouthpiece (Fig. 3). The apparatus consists of four parts, viz: the lower piece or hearth,

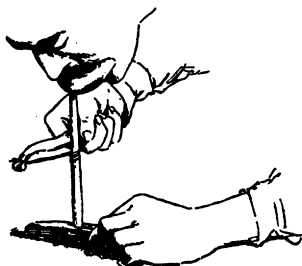


FIG. 3.—Eskimo mouth fire drill.

which may have fire-cups on the sides with a canal opening upon a flat step, or the holes may be bored on a central groove; the spindle; the mouthpiece or hand-rest with a stone bearing; and the cord which may be stretched on an ivory bow, or fitted with two

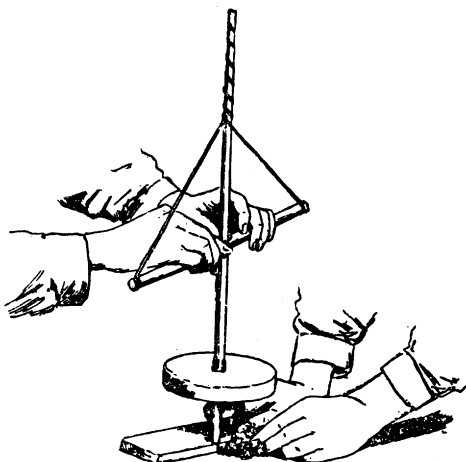


FIG. 4.—Iroquois pump-drill for making fire.

handles as the cord on the ancient Hindoo fire-drill. The bow and mouthpiece are not found south of Norton Sound, Alaska; the cord and hand-rest are exclusively used. At other points both

methods occur. The stepped variety of hearth also is found only in Southwestern Alaska, while the central holes on a groove are found from Labrador to Norton Sound, exclusively, and occurs, associated with the other, at the extreme southern range of the Eskimo.

The pump-drill (Fig. 4) is one that was used in making new fire in the white dog feast of 1888 by the Onondagua Iroquois of Canada. They are usually made of elm wood, and often the spindle was hewn from part of a sapling with its tap root forming the lower part. A mass of wood was left for a weight.

Mr. Wallace describes the sawing method thus: "A sharp-edged piece of bamboo is rubbed across the convex surface of another piece on which a small notch is first cut. The rubbing is slow at first and gradually quicker till it becomes very rapid, and the fine powder rubbed off ignites and falls through the hole which the rubbing has cut in the bamboo." * (Fig. 5).

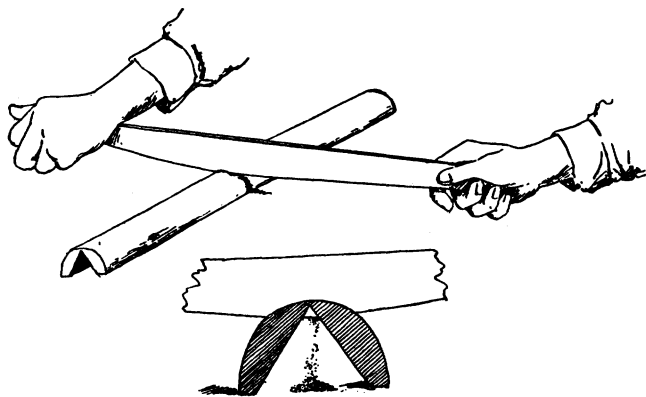


FIG. 5.—Fire saw. Section.

Two varieties of sawing have lately come to the writer's notice, one of which has marked a new locality in the distribution of this phase of fire-making. It has heretofore been observed at five points, viz: Among the Tungaras of British North Borneo (Daly), the Javanese (d'Almeida), the Karens and Chittagong Hill tribes of Burma (Dr. Luther and Mr. Lewis), the Malays of the islands (Wallace), and in Australia (Smyth).

*The Malay Archipelago. New York (1869) Harper's, p. 332.

It has lately been practiced at the village of Ubumkara in S. E. New Guinea. Mr. H. O. Forbes writes: "The operator first selecting a dry fragment of wood makes in it a split in which he inserts a peg to keep it agape; into this split he places a morsel of tinder plucked out of his girdle or skirt; he next cuts from his dry coil of rattan a short length, lays it on a dry leaf on the ground and places over it the tinder plug in the cleft stick; then placing his knee or foot on the end of the stick he pulls the rattan cord rapidly to and fro under it till the tinder ignites, when, by blowing gently through the cleft, he fans the spark into a flame. The whole operation is the most effective and rapid of any native fire-producing contrivance that I know."* Mr. Forbes' account is perhaps the first that has ever been published.

Mr. S. B. J. Skertchly describes another variant of the fire-sawing process in which the parts of the usual apparatus are reversed. The saw is set up on the ground and the convex side of a bamboo piece that bears a groove with a hole that communicates with the tinder placed on the upper concave side is slid rapidly along the edge of the saw. This is the common way among the Cagayu-sulu. The usual method, in which the sharp-edged saw is rubbed across a piece of bamboo, is practiced in Sulu, Perak, Selangore, and other places.†

This gives a distribution throughout the East Indies, beginning at the Asiatic continent and finding its way into Australia probably by Cape York. It will doubtless be found in the Malay Peninsula, Sumatra, the Celebes, and perhaps to the north in the Philippines. The writer was informed in 1889 that the sawing method is practiced also in Siam. The method is called the Malay or sawing method‡ and the type was founded on Wallace's description. It seems to be coincident with Malay influence. While there is little data to disprove this statement, it seems strange that the method was not carried further east by the Malayo-Polynesian wave of migration. The range of bamboo would seem to determine it, but both in Burma and Australia we find the parts of the apparatus cut out of wood.

The Polynesian islands are characterized by the plowing method of making fire, a variety of which is found also in Australia.

* Proc. Roy. Geog. Soc., XII, p. 562.

† J. Anthropol. Inst. XIX, 4, May, 1890, p. 456.

‡ Smithsonian Report, ii, 1888-9, p. 569.

The plowing method (Fig. 6) as practiced in Samoa was described for the writer by Lieutenant W. I. Moore, U. S. N. The Samoans prepare a short cylindrical pointed stick and a larger billet of wood, on which a shallow groove is sometimes begun. The smaller stick is clasped between the hands at an angle of 45° and projected to and from the body along the groove in the lower piece on which the native kneels. At first he forces it along a range of 6 or 7 inches, till the wood begins to wear away and is pushed into a little heap at the end of the groove; then he gradually accelerates and moves with a shorter range until, when he moves the stick with great rapidity, the brown dust ignites.

The flint and pyrites strike-a-light is used somewhat as the flint and steel, with which process most persons are familiar.

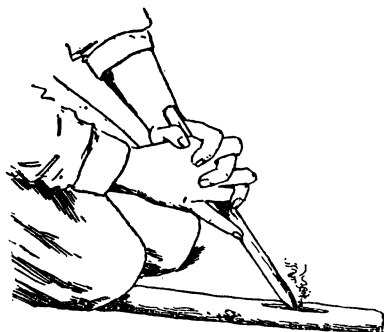


FIG. 6.—Samoan fire sticks.

Examination of many specimens of wooden fire apparatus shows that both the drill or upright, movable piece and the hearth or lower piece are made of dry, inflammable wood, and, contrary to the common belief, quite often of pieces from the same tree. Wood that is "punky"—that is, soft from dry rot or worm-eaten—is preferable. This is the kind of wood spoken of by Festus and used by the Vestals: "Mos erat tabulam felicitis materiæ tamdiu terebrare quousque exceptem ignem cribro ænis Virgo in ædem ferret." "It was the custom to bore into a plank of combustible wood upon which they had hitherto made fire, which a Vestal virgin received on a brazen sieve, which she carried immediately into the temple." *

* Festus: *Ignis vestæ*.

This kind of wood is not only easier of ignition, but it is ground off easily and more readily retains the heat generated by friction. In strong, skillful hands, however, fire can be made from wood that does not wholly meet these conditions, but there will be more failures than successes.

Woods vary widely in combustibility, depending perhaps on their density, coloring matter, or chemical constitution. For instance, it is practically impossible to make fire of black walnut; while dry, soft white maple, not decayed, is good for the purpose when drilled with the bow. The vascular, starchy, flowering stems of plants have always been favorite fire-generating material.

The Eskimo make use of nearly every kind of dry wood, because the compound drill enables him to give strong pressure with high rate of speed, thus generating enough heat to ignite wood that is quite intractable by the simple two-part drill. This invention followed from the conditions of the Eskimo's frozen home, where driftwood is his main dependence and choice is restricted. The Eskimo, however, always selects the best wood at hand, thus showing that he appreciates the advantages of proper material.

The flint and pyrites method is thought to compete with the twirling sticks for priority of invention. The antiquity of the latter has been set forth. By one theory its distribution is interpreted to mean that it was the heritage of the human race before it separated into groups. By the other theory it was rediscovered many times—a natural suggestion, for the materials are always at hand. The flint and pyrites method seems to be indicated by the few lumps of pyrites found in prehistoric stations in England and on the continent. However, it cannot be affirmed that the pyrites so found was used for fire-making. In this connection it would be of interest to know whether a piece of pyrites and scraper-like piece of flint have ever been found close together in conditions implying remote antiquity.

The strongest argument against the use of the pyrites method in a very primitive state of society is that it presupposes the selection, preparation, and preservation of tinder. Wooden fire-sticks, on the other hand, form their own tinder. In the pyrites strike-a-light the sparks are struck off at so low a heat that they will not inflame any except very "quick" tinder. With good tinder, however, the pyrites method is more expeditious, while the apparatus is more compact, and hence is an improvement following the line of elaboration.

Apparently preceding the flint and pyrites in the usage of several tribes is the method of striking two pieces of pyrites together, said to have been practiced by the Arctic Eskimo of a few localities.

Another origin of fire-making has been discussed. It is stated by several writers that while working flint a spark may have fallen into dry material, and that in this manner early man received the suggestion of fire-making. But the sparks produced by knocking two pieces of flint together will not, to the best of my knowledge from experiment, inflame tinder.

In view of the foregoing facts, it may be said with regard to the probable origin of fire-making: 1. That the selection of two sticks of wood for fire-making is more probable and natural than the use of iron-stone and flint. 2. That fire-making by means of sticks is easy, and hence probably came first in order of time. 3. That the pyrites method is more complex, and hence by the laws of invention comes later. It is unnatural that an expeditious mode of kindling fire afresh by flint and pyrites should have been supplanted by a less facile method. Inventions do not retrograde. Numerous cases may be cited where flint and steel have superseded the fire-sticks, but none show the opposite order of procedure. Dr. Tylor concludes: "To sum up now in a few words the history of the art of making fire, it appears that the common notion that the friction of two pieces of wood was the original method used has strong and wide-lying evidence in its favor, and that very little can be alleged against it." *

Apparently the Polynesian plowing method and the sawing method illustrate the most simple forms of friction apparatus. A plausible supposition bearing on this plan is that man got the hint from nature by observing the rubbing of two dry branches in high winds. The Polynesian method has the following in its favor: With one stick a furrow can be plowed on another without the intervention of a knife or other tool to cut a groove or a hole in which to start a drill, and hence it may have been invented during the earliest times. Its very simplicity renders the tool more difficult to work; for, in a wind, fire-making would be almost impossible. Again, when the dust collects at the end of the groove, the violent movements at the last moment are liable to scatter it. In the case of the rotary drill this is not so, the ground-off dust being kept in the canal. In the sawing plan, the preparation of the

* Early History of Mankind, p. 260.

knife, cutting the groove, placing the tinder underneath for draft, imply a more highly differentiated invention.

The rotary drill is the simplest aboriginal fire-making apparatus. Major Powell's three stages of culture may be defined by the kind of fire-apparatus used: 1. Savages make fire with two pieces of wood; 2. Barbarians with flint and steel or pyrites; 3. Civilized man by chemistry.

Since writing the foregoing the author has read Mr. Sidney B. J. Skertchly's paper on "Fire-making in North Borneo," in the May number of the Journal of the Anthropological Institute of Great Britain and Ireland.

In this communication the first complete description of the *besi api* or fire-syringe is given; the names of the parts, the moulds used in casting the cylinder, the measurements, etc.

All the natives of this part of Borneo use the well-known fire-drill. Mr. Skertchly has noted an essential point in the lower member of this appliance—the groove cut down the edge to collect the dust in which the fire rises.* Prof. A. C. Haddon, in the discussion following this paper, pointed out that the slot cut in the drill hole was not made by the Torres Straits Islanders, nor by the natives of Queensland, and therefore is not essential. Professor Haddon is right, in a sense. Fire *can* be made on a plane surface] without groove, but the difficulty is so great that it is almost prohibitive, and the slot is essential to quick and easy fire-making.

The writer has made fire without the slot, but finds it necessary to employ the compound drill, and to keep the parts from binding or jarring. He has rarely seen pieces of fire-making apparatus without the slot, groove, or a substitute for it. One of these was a model of a Hindoo sacred fire-drill, sent from Oxford Museum to the United States National Museum by Mr. Henry Balfour. The Victoria drill figured in R. Brough Smyth's great work,† has fire-cups directly on the edge of a rounded piece, so that when the drill begins to cut the wood-meal falls down over the edge in a heap as in the slot. Often connecting holes perform this important office.

A spindle of large diameter, with the outline of a low, flat arch (Tudor arch) at the abrading end, will not disturb the ring of dust that forms around its circumference (the difficulty with the unslotted

* See Smithsonian Report, ii, 1888, p. 557.

† The Aborigines of Victoria, i, p. 393.

hole), and if the ignition point is reached before the spindle cuts very deep, the experiment will be successful. This sort of drill has to be worked by a cord or bow.

Those who have previously written on this subject are to be pardoned, because they had no knowledge of the exigencies of the process and the minute particulars required. Drawings also were not accurate in the small points which were left to the artist. I have known professional draughtsmen to omit the slot from a drawing of a fire-drill. This has doubtless often led to misconceptions as to the position of the fire-hole.

Mr. Skertchly carefully describes the sawing method and notes an interesting variation.

Fire is sometimes made in Borneo by striking a bit of broken crockery on a bamboo, which requires great skill.

A plate of excellent figures accompanies Mr. Skertchley's article, and his paper was illustrated by a series of photographs taken by Mrs. Skertchly, showing the methods of obtaining fire from the instruments described. Several drawings of fire-syringes were also exhibited by members of the institute. In the discussion, the veteran Dr. Rae gave an account of Eskimo fire-producing, which terminated this extremely interesting *seance*.

The above paper was read before the society January 4, 1890. In the course of his remarks Mr. Hough exhibited various primitive apparatus for fire-making which are contained in the National Museum collection and are illustrated above. From several of them he succeeded in creating a flame.

CANNIBALISM IN NEW IRELAND.—Cannibalism is still generally practised and freely acknowledged by the natives of the island of New Ireland, now called New Mecklenburg by the Germans, who have established a "protectorate" over it. Strangers—that is, people from a different village or tribe—only are eaten, and each person who partakes of the feast has to pay a certain sum of shell money to the owner—that is, the man who killed the "game." (Count Joachim Pfeil, in *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* for March, 1890.)

CUSTOMS AND BELIEFS OF THE TRIBES OF SOUTH AFRICA.—A long and interesting general account of the ethnography of South Africa has recently appeared in the *Revue Scientifique* ("Coutumes et croyances des tribus de l'Afrique australe," par J. Macdonald. *Rev. Sci.*, v. 45, Nos. 21, 22, May, 1890, pp. 642-8, 679-87).

This article, which appears to be a compilation, although the sources of information are seldom referred to, after giving a general sketch of the tribes dealt with, their names and social organization, proceeds to describe them in detail under the following heads: Birth and posterity; puberty, including the ceremonies of circumcision and initiation; marriage; sickness and death; property and inheritance; fire-making; food; hunting and fishing; agriculture; warfare; religion; oaths; salutations; arithmetic; measure of time; games and dances; magic and divination, and rain-making.

BUSHMAN ART.—G. Weitzecker sends to the bulletin of the Italian Geographical Society copies of some interesting examples of Bushman rock-paintings recently discovered by himself in Basutoland. These represent, first, a man milking, an eland grouped with four apes, two elands together (one of these is remarkably good), and a large group of eighteen figures representing a number of Bushwomen, with their children, flying from a party of Matabele Kafirs. This picture is full of life, and, according to Mr. Weitzecker, illustrates many important ethnographical details, which he describes fully in the text. (*Bollettino della Società Geografica Italiana*, April, 1890.)

"EXO GAMY" IN NEW BRITAIN.—The natives are divided into two marriage groups, called "Maramara" and "Pikalaba." Marriage of two persons within one of these groups appears to be punishable with death to the woman and a heavy fine to the man. A person of one group can thus only marry one of the other, and the children belong to the mother's group.

Both groups show great reverence for an insect, a species of Mantis, and any one who should kill or injure one of these would be severely punished. (Count Joachim Pfeil in *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, March, 1890.)